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A descriptive analysis of the evolution of occupational mismatch in Europe

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Abstract

Using the two surveys on adult skills- IALS and PIAAC- we investigate the evolution of occupational mismatch in Europe. We focus on both overeducation and overskilling and study how the incidence of the two phenomena in the years covered by the surveys: mid 90s and 2011. Our main findings are that in both time periods a substantial share of the working population is in a mismatched job, with great heterogeneities by countries and that overeducation and overskill seem to capture two distinct phenomena as the share of individuals who is mismatch in both categories is low relative to the ones who are mismatch in either one of the two. In addition we exploit heterogeneities by countries and by age groups and find that: (a) a group of countries (PL, SE and UK) have decreased their share of only overeducated workers, compensating it with an increase in share of overskilled workers; (b) overeducation and overskilling seem to decrease as individuals get older (c) greater overeducation is observed for the younger cohorts, especially in BE, DK, IE, FI, NL and SE.

1 Introduction

In the last few decades, socio-economic changes such as increasing global competition, the skill-biased technological change or the ageing of population have resulted in a labour market situation where it is difficult to find the right people for the right jobs. Occupational mismatch has become a major concern as it proves to be pervasive, widespread and, especially persistent in developed economies, resulting on real costs on individuals, businesses and society as a whole (Cedefop 2010,). At the same time we have witness an increase in the general level of education in European countries, also driven by the European Commission's effort in pushing member states to decrease the share of early school leavers and increase the share of tertiary graduates.¹ Nevertheless, the increase in educational attainment not always perfectly corresponds to an increase in skill of the overall population, as shown in Flisi at al. (2015). Thus, changes in level of education and of skill within the population can be linked to interesting consequences in the overall level of occupational mismatch in the different countries. The aim of this brief is to exploit the availability of rich data from the 1994-1998 International Adult Literacy Survey (IALS) and the 2012 Survey on Adult Skills (PIAAC), designed to be comparable across individuals, to conduct empirical analysis on the evolution over time of the incidence of occupational mismatch, through a variety of EU countries.

2 Data and Definition

As already mentioned, for the purpose of this research exercise, we rely on data from the 1994-1998 International Adult Literacy Survey (IALS) and the 2012 Survey on Adult Skills (PIAAC). Thus, IALS provides the world's first comparable estimates of the levels and distributions of cognitive foundation skills in the adult population. Three separate data collections spanning a four years period were conducted in 24 countries or regions (see **Error! Reference source not found.**). The type of individual skills investigated is literacy skills, defined as the ability of "using printed and written information to function in society, to achieve one's goals, and to develop one's knowledge and potential" (Statistics Canada, 2003, p.15).

Table 1. Waves and countries participating in IALS

	YEAR		
	1994	1996	1998
COUNTRIES	Canada (English and French-speaking populations), France, Germany, Ireland, the Netherlands, Poland, Sweden, Switzerland (German and French-speaking regions), United States of America	Australia, Belgium (Flemish community), Great Britain, New Zealand Northern Ireland	Chile, the Czech Republic, Denmark, Finland, Hungary, Italy, Norway, Slovenia Italian-speaking region of Switzerland

¹ Europe 2020. A strategy for smart, sustainable and inclusive growth, COM (2010)2020; more information on http://ec.europa.eu/europe2020/index_en.htm.

NOTE: List of countries participating in IALS in the three rounds (1994, 1996, 1998)

Similarly, the Survey of Adult Skills, an international survey conducted as part of the Programme for the International Assessment of Adult Competencies (PIAAC), was run in 2011 and 2012, and measures key cognitive and workplace skills needed for individuals to participate in society and for economies to prosper. The survey assesses three domains of cognitive skills, namely: literacy, numeracy and problem solving in technology-rich environments (PSTRE).

Both surveys have been designed to be representative of the civilian, non-institutionalized population aged 16-65 in the different countries. For the purposes of our analysis, we restrict the sample to individuals aged 15 to 65 and currently employed.

The EU countries that participated in both surveys and for which it is possible to study the evolution of literacy skills over time are 11: Belgium-Flanders (BE), Czech Republic (CZ), Denmark (DK), Finland (FI), Germany (DE), Ireland (IE), Italy (IT), The Netherlands (NL), Poland (PL), Sweden (SE), and United Kingdom (UK). It should however be pointed out that while for IALS the United Kingdom includes the whole country (Great Britain + Northern Ireland), only England and Northern Ireland participated in PIAAC, so there is a discrepancy in the representation of the country in the two surveys. Furthermore, in PIAAC, Germany does not include age as a continuous variable, which forced us to exclude it from the analysis. We are therefore left with 10 EU countries.

To successfully face this exercise's challenge, a major step is being able to measure individual occupational mismatch appropriately. Beyond educational attainment which is a reasonable candidate to proxy individuals' competences, individual's skills arise as a superior and more reliable approach to measure occupational mismatch given the greater demand for more information-processing and high-level cognitive skills that do not necessarily need to be acquired through the educational system. Both IALS and PIAAC surveys measure individuals' competences allowing computing occupational mismatch based on: (1) education related variables (overeducation) and; (2) on the level of proficiency on the specific skills (overskilling).²

In a former paper by Flisi et al.(2016), the authors provide an extensive review of all the existing methods for measuring mismatch and investigate the differences between education and skill mismatch, building several indicators available from PIAAC data. Their results show that education and skill mismatch are two distinct phenomena, and that differences exist also in measures of skill mismatch according to the way they are calculated. They show that building three measures of mismatch (one measure of education mismatch, either objective or subjective, one measure of skill mismatch based on the distribution of skills in the population and one measure of skill mismatch based on the comparison between skills used at work and skills possessed) would be enough to now the overall situation of occupational mismatch at the individual and/or country level. Using the information contained both in IALS and PIAAC, we were able to build the following two indicators in both surveys:

1. **Education mismatch** using level of education. We compare the level of education of the individual with the modal level of education of all the individuals

² We focus on upward occupational mismatch, which refers to the situation in which a worker's educational attainment (skill level) exceeds the educational qualification (skill level) required for the worker's job, leading to a condition of overeducation/overqualification (overskilling/skill surplus). The unprecedented rise in the supply of university and college graduates over the past few decades in several OECD countries and the more negative consequences compared to downward mismatch at both the individual and aggregate levels (for a review, see Hartog 2000; Rubb 2013; Brynin 2002; Cedefop 2010; Ortiz 2010; Quintini 2011 or Dolado et al. 2002) motivated our choice.

in the same country and ISCO 1 digit occupation.³ We defined an individual as mismatch (overeducated) if his level of education is higher than the modal level of occupation in his occupation and country.

2. **Skills mismatch** using skill level for literacy based on 1 SD rule. We compare the skill level of the individual in literacy (as measured by the first plausible value –variable PVLIT1) with the average skill level in literacy of all individuals in the same country and ISCO 1 digit occupation. We define an individual as mismatched (overskilled) if its literacy skills level is more than 1 standard deviation higher than the average in his ISCO 1 digit occupation and country.

Unfortunately in IALS there is no information on the skill used at work, and thus we cannot recover measure of mismatch based on this information. Similarly, the limitation to ISCO 1 digit occupation in IALS prevents us from replicating the same education and skills mismatch indicators produced in the mentioned paper.

In this exercise, to calculate the measure of skill mismatch, we focus on literacy skills, since PIAAC was specifically designed to link to IALS in the domain of literacy. Thus, according to OECD (2012), literacy is defined in PIAAC as “understanding, evaluating, using and engaging with written texts to participate in society, to achieve one’s goals, and to develop one’s knowledge and potential”. In the literacy domain, around 60% of the assessment items in PIAAC were drawn from IALS (OECD 2013, p. 14), so as to ensure the strong link between surveys. However, in IALS, literacy was assessed on two separate scales (prose and document literacy); while in PIAAC there is one single scale. As explained in the updated documentation for IALS, following PIAAC, the prose and document scales have been re-scaled and combined into one literacy scale; this new scale allows for carrying out of trend analysis with PIAAC. Practically speaking, this implies that in the newly released microdata for IALS, new plausible values for literacy are included that are perfectly comparable to those provided by PIAAC. In both IALS and PIAAC literacy skills are measured on a scale that goes from 0 to 500 points.

The working samples used to compute the different measures of mismatch consists of employed individuals only, excluding self-employed. Further, following Allen et al. (2013), we decided to drop individuals who, despite being formally in employment (objective status), are self-reportedly pupils/students or apprentices/interns (subjective status).

3 Results

3.1 The incidence of different types of mismatch and their overlap across countries and time

Error! Reference source not found. below reports the proportion of individuals who are mismatched (overeducated or overskilled) according to the two mismatch indicators computed. As expected, the skill mismatch indicator, based on the use of the standard deviation as cut-off points for mismatch, tends to be rather stable between countries (around 15%) and over time by definition, so it is meaningless to compare it between

³ The ISCO 1 digit occupation divides jobs into 10 major groups: (1) Managers; (2) Professionals; (3) Technicians and associate professionals; (4) Clerical support workers; (5) Service and sales workers; (6) Skilled agricultural, forestry and fishery workers; (7) Craft and related trades workers; (8) Plant and machine operators, and assemblers; (9) Elementary occupations; and (0) Armed forces occupations.

surveys. On the contrary, the over education measure show some pronounced variability between countries and across time that are worth commenting. First, we have a group of countries composed by BE, CZ, IT and NL where the share of overeducation ranges from 15 to 30% in IALS and these figures remain more or less stable over more than a decade later in PIAAC. Second, we find a set of countries composed by PL, SE and UK where the level of overeducation largely decreased ($|\Delta| > 0.10$) between the two periods - highlighted in green. In particular the numbers for UK and PL are quite impressive, as they halved the share of mismatch individuals in these 15 years. Last, DK, FI and IE have slightly increased their level of educational mismatch for the overall population though this increase is smaller than the decrease mentioned above ($|\Delta| > 0.05$) - highlighted in red.

We report in red and green the countries with respectively the highest and lowest share of mismatch population in each of the two surveys. It is also worth mentioning that in FI, where we observe an increase in the share of overeducated workers between the two considered periods, the absolute value of overeducation measured in PIAAC it is still low compared to the other countries.

Table 2. Percentage of over educated or over skilled individuals according to the different measures of mismatch.

Country	Share of over skilled		Share of over educated	
	(1)	(2)	(3)	(4)
	IALS	PIAAC	IALS	PIAAC
BE	0.146	0.154	0.303	0.288
CZ	0.150	0.149	0.150	0.120
DK	0.154	0.145	0.254	0.319
FI	0.148	0.148	0.116	0.176
IE	0.150	0.151	0.331	0.387
IT	0.151	0.159	0.197	0.216
NL	0.146	0.142	0.223	0.240
PL	0.156	0.156	0.244	0.100
SE	0.155	0.154	0.328	0.211
UK	0.140	0.148	0.332	0.153

NOTE: In the table we report the proportion of individuals who are overskilled only- columns (1- in IALS) & (2- in PIAAC); overeducated- columns (3- in IALS)&(4- in PIAAC). We highlight in green decrease in mismatch greater than 5 percentage points between the two periods; in red increase in mismatch greater than 5 percentage points between the two periods. In red and green text colour we show the lowest and highest value of mismatch in each group, and each survey.

With only this information it is not possible to understand why we observe such increase and decrease, thus always at a very descriptive level, in an attempt to better understand the reasons for such a various trends, we look at the socio-economic characteristics of the population in the different countries (see **Error! Not a valid bookmark self-reference.**). Interestingly, we observe that while all countries experience an increase in the share of highly educated individuals, this was particularly larger in PL, SE and the UK and accompanied by an increase in the share of medium level of education individuals for PL and UK. At the same time the distribution within level of occupation remain very similar between the two time periods, at least in SE and UK. We may speculate that, this rise in educational attainment has certainly increase the level of education of the peer group (i.e. ISCO 1C reference), thus decreasing the level of educational mismatch. In IE we observe a similar decrease in proportion of individuals with low education and medium education and a significant increase in the shares of individuals with high

education, and at the same time we also notice a decreased in semi-skilled blue occupation, compensated by an increased in the share in skilled and semi-skilled white. Maybe for these reasons we don't observe a decrease in the overall share of individuals who are overeducated, as now more people have higher education but more people are also in higher level occupations.

On the contrary, for countries like IE, DK and FI, this increased in highly educated individuals seems offset by the decrease in medium educated ones, thus causing a small overall increase in over education.

Table 3. Socio-economic characteristics employed individuals aged 15-65 by country: IALS and PIAAC

			BE	CZ	DK	FI	IE	IT	NL	PL	SE	UK
AGE GROUP	16-30	IALS	0.230	0.179	0.191	0.189	0.327	0.197	0.249	0.203	0.202	0.237
		PIAAC	0.205	0.251	0.114	0.169	0.178	0.131	0.185	0.596	0.178	0.209
	31-45	IALS	0.485	0.422	0.431	0.451	0.407	0.506	0.484	0.514	0.380	0.446
		PIAAC	0.389	0.392	0.334	0.366	0.500	0.464	0.356	0.210	0.349	0.407
	46-60	IALS	0.268	0.388	0.352	0.341	0.228	0.274	0.252	0.268	0.373	0.272
		PIAAC	0.385	0.299	0.431	0.383	0.271	0.370	0.396	0.173	0.369	0.324
	61-65	IALS	0.017	0.011	0.027	0.018	0.038	0.023	0.014	0.015	0.045	0.045
		PIAAC	0.021	0.058	0.121	0.082	0.051	0.034	0.062	0.021	0.105	0.060
EDUCATION	LOW	IALS	0.178	0.419	0.191	0.208	0.429	0.344	0.345	0.553	0.234	0.496
		PIAAC	0.116	0.043	0.148	0.081	0.142	0.278	0.240	0.071	0.084	0.194
	MEDIUM	IALS	0.610	0.409	0.602	0.640	0.441	0.489	0.341	0.336	0.618	0.327
		PIAAC	0.455	0.702	0.358	0.589	0.362	0.508	0.399	0.592	0.505	0.356
	HIGH	IALS	0.210	0.170	0.206	0.151	0.129	0.166	0.313	0.109	0.147	0.175
		PIAAC	0.429	0.254	0.493	0.330	0.496	0.214	0.361	0.336	0.411	0.451
OCCUPATION	SKILLED	IALS	0.176	0.487	0.430	0.472	0.309	0.386	0.555	0.290	0.556	0.400
		PIAAC	0.469	0.402	0.545	0.487	0.451	0.376	0.539	0.332	0.535	0.418
	SEMI-SKILLED WHITE	IALS	0.621	0.140	0.263	0.213	0.267	0.322	0.215	0.174	0.190	0.319
		PIAAC	0.258	0.273	0.221	0.259	0.339	0.295	0.283	0.282	0.260	0.379
	SEMI-SKILLED BLUE	IALS	0.201	0.314	0.225	0.255	0.329	0.201	0.173	0.451	0.214	0.195
		PIAAC	0.181	0.254	0.148	0.197	0.131	0.217	0.112	0.300	0.170	0.117
	ELEMENTARY SKILLS	IALS		0.057	0.079	0.058	0.094	0.090	0.055	0.083	0.038	0.083
		PIAAC	0.091	0.072	0.086	0.056	0.079	0.112	0.067	0.085	0.036	0.085
GENDER	FEMALE	IALS	0.425	0.532	0.468	0.473	0.422	0.448	0.430	0.471	0.503	0.490
		PIAAC	0.496	0.514	0.506	0.515	0.560	0.480	0.500	0.431	0.504	0.585

NOTE: In the Table we report descriptive statistics on the working sample in the two surveys. Highlighted in blues are significant increases between IALS and PIAAC (more than 10 percentage points); highlighted in red are decreases between IALS and PIAAC, as for distribution in different levels of education and occupation.

Following previous work (Flisi et al., 2016) we also look at the incidence of occupational mismatch at the individual level. Thus, we combine the mismatch information from the two indicators computed and allocate individuals within the sample to only one of the following mutually exclusive groups:

(a) Matched: individuals who are not mismatched in any of the two indicators considered.

(b) Severely/mixed mismatched: individuals who are mismatched with respect to both education and skill.

(c) Skill mismatched: individuals who are skill mismatched only.

(d) Education mismatched: individuals who are only education mismatched.

This classification, will allow us to better understand the extent of the mismatch problem in each country, the percentage of mismatched individuals, the predominant type of mismatch for each country, and their evolution across time. Results are provided in **Error! Reference source not found.**, where the sum of the three types of mismatch (b) + (c) + (d) is also provided in columns 4 and 8. In general, in both years, between 55% to 80% of this European countries' population is occupationally matched, with values ranging from less than 60 % for SE to 77% in FI, in IALS and from 56% for IE to 77% in PL in PIAAC. Moreover, the share of severely/mixed mismatched people is generally rather low and stable through time and across countries, while the rest of the population share is split between individuals who are only skill mismatched or only education mismatched. This result supports the notion that skill mismatch and education mismatch provide a different picture of and different information regarding occupational mismatch, again demonstrating that an analysis should not focus on one single dimension of occupational mismatch because most of the population is mismatched on either education or skills.

Table 4. Percentage of overeducated only, overskilled only and both overeducated and overskilled by country

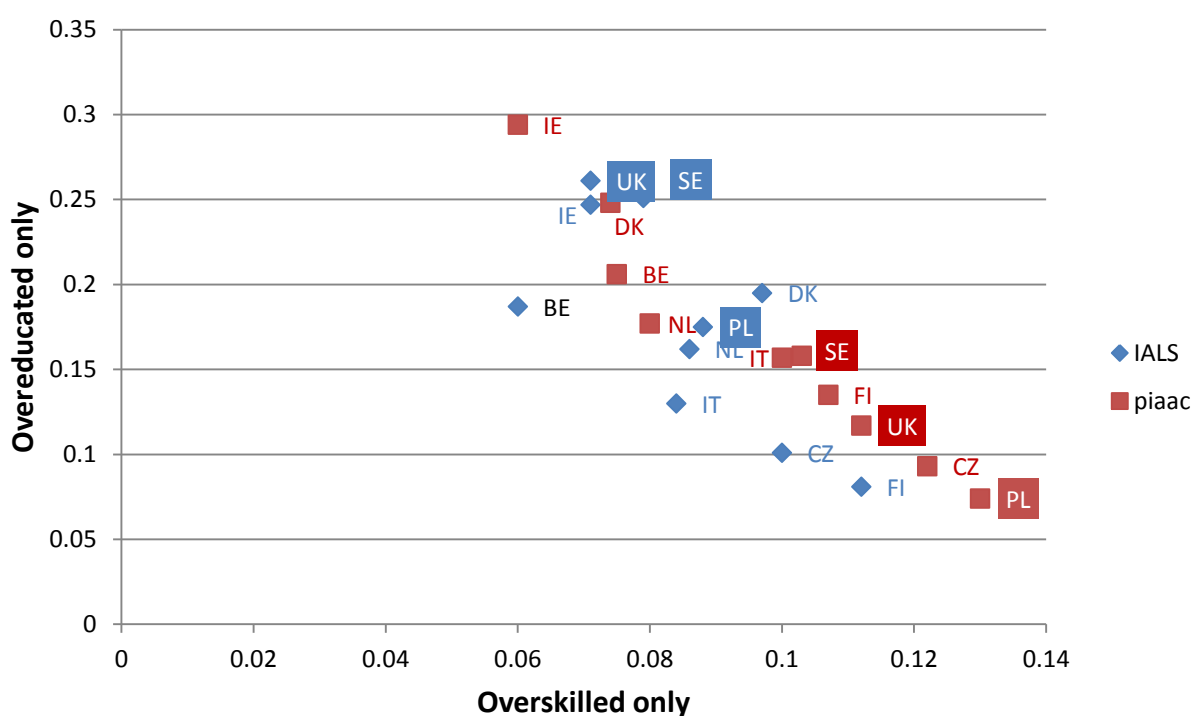
	IALS				PIAAC			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Country	Overskill only	Overeducation only	Both	TOTAL	Overskill only	Overeducation only	Both	TOTAL
BE	0.060	0.187	0.060	0.307	0.075	0.206	0.076	0.356
CZ	0.100	0.101	0.047	0.248	0.122	0.093	0.026	0.240
DK	0.097	0.195	0.056	0.348	0.074	0.248	0.071	0.393
FI	0.112	0.081	0.031	0.224	0.107	0.135	0.040	0.283
IE	0.071	0.247	0.075	0.393	0.060	0.294	0.090	0.444
IT	0.084	0.130	0.066	0.280	0.100	0.157	0.057	0.314
NL	0.086	0.162	0.060	0.308	0.080	0.177	0.061	0.318
PL	0.088	0.175	0.067	0.329	0.130	0.074	0.026	0.230
SE	0.079	0.251	0.075	0.406	0.103	0.158	0.050	0.311
UK	0.071	0.261	0.068	0.399	0.112	0.117	0.035	0.263

NOTE: In the table we report the proportion of individuals who are Overskilled only- columns (1)&(5); overeducated only- columns (2)&(6); both overeducated and overskilled- columns (3)&(7); and the total proportion of mismatch individuals-- columns (4)&(8). We highlight in green decrease in mismatch greater than 5 percentage points between the two periods; in red increase in mismatch greater than 5 percentage points between the two periods. In red and green text colour we show the lowest and highest value of mismatch in each group, and each survey.

Considering the two time periods, we observe how countries like PL, SE or UK have decreased their share of only overeducated workers, partially compensating it with an increase in share of overskilled only individuals. For all three countries the total mismatch has decrease. We may then speculate that both individuals' education and skills have increased in these countries better matching former overeducated individuals but also creating a new pool of overskilled ones.

Moreover, in general, we observe that the countries with higher percentages in one type of mismatch have lower percentages in the other, suggesting that a negative correlation exists between the two types of mismatch. This pattern is more evident in recent years with PIAAC data as can be visualised in **Error! Reference source not found.**

Figure 1. Scatter plot overeducation only and overskilled only.



Note: in the figure we plot on the x-axis the proportion of individuals who are overskilled only, and on the y-axis the proportion of individuals who are overeducated only. Red squares refer to PIAAC data, while blue diamonds refer to IALS data.

3.2 Cohort and ageing effects.

In this section, we try to better understand the separate effects of ageing and cohort on individual occupational mismatch. When considering **cohort effects**, we are taking into account that different generations may get better (worse) opportunities to find a job that matches their skills/educational attainment depending on the characteristics of labour markets at different moments in time that may more easily match individuals to labour (or not).

On the other hand, individuals can lose or improve their level of skills and/or educational attainment as time passes by, moreover, they can also change jobs increasing/decreasing their chances of being matched given their accumulated job experience; this is the **ageing effect**.

Ideally, we would need longitudinal data, that is, a survey that follows individuals from different age cohorts throughout their lives. This type of data is not available, since neither IALS nor PIAAC include a panel component. However, as already mentioned, PIAAC was specifically designed to link to IALS in the domain of literacy, so that the

information on literacy skills provided by the two surveys is comparable. Since both surveys track a representative sample of the population (therefore providing an unbiased estimate of the distribution of literacy skills at that point in time), and they are implemented between 13 and 17 years apart from each other, their design allows us to build synthetic cohorts, that we can use for our analysis. Since IALS was carried out at different points in time for different countries, the number of years between observations varies depending on the country, however, for this exploratory analysis we will consider an average of 15 years and the following age cohorts which can be observed in both surveys, namely: (Cohort 1) 15-30; (Cohort 2) 31-45; (Cohort 3) 46-60; and (Cohort 4) 61-65.

Results for the cohort effects are reported in **Error! Reference source not found.** and **Error! Reference source not found.** for all countries studied. The left-hand side (or column 1) compares the share of education mismatch individuals in IALS (blue line) with the share of education mismatch individuals of the same age in PIAAC (red line) by age groups. If the red line is above (below) the blue one, there are on average more (less) individuals overeducated in that age group in PIAAC than overeducated individuals of the same age in IALS, which implies that the new cohorts are more (less) skilled than the past ones. The right-hand side (or column 1) reports the same results for overskilling. Results for the older cohort group (61-65) have to be interpreted with care since the sample size can be small for some countries.

Mixed results arise:

- Overeducation seems to be a greater problem nowadays as, in general, the share of overeducated individuals in PIAAC exceeds those in IALS for all countries except PL, SE and UK. In particular, the phenomena is stronger among younger individuals (especially in IT, NL, BE, DK), as it would be expected (from 16 to 45) with a decreasing trend and, with figures converging to almost equal share of overeducation between IALS and PIAAC for the age group 45-60.
- Particular attention should be paid to young individuals in DK, FI and IE (the latter to a less extent) as they seem to be more affected by the overeducation problem than their older counterparts and the problem seems to have worsened in the last 15 years.
- On the contrary, overeducation seems to be a smaller problem in PL, SE and UK nowadays, compared to 15 years ago figures, however while the trend is a decreasing one in Poland (younger individuals are more overeducated than older ones), this seems flatter in UK and more worrisome in SE a country that has shown a high level of overall mismatch (see
- Table 4).
- Regarding overskilling, if we drop those aged 61 to 65, the overall trend is of decreasing share of overskilled individuals among older age groups, however, not significant differences are observable between both surveys.

Figure 2. Cohort effect: BE, CZ, DK, FI, IE

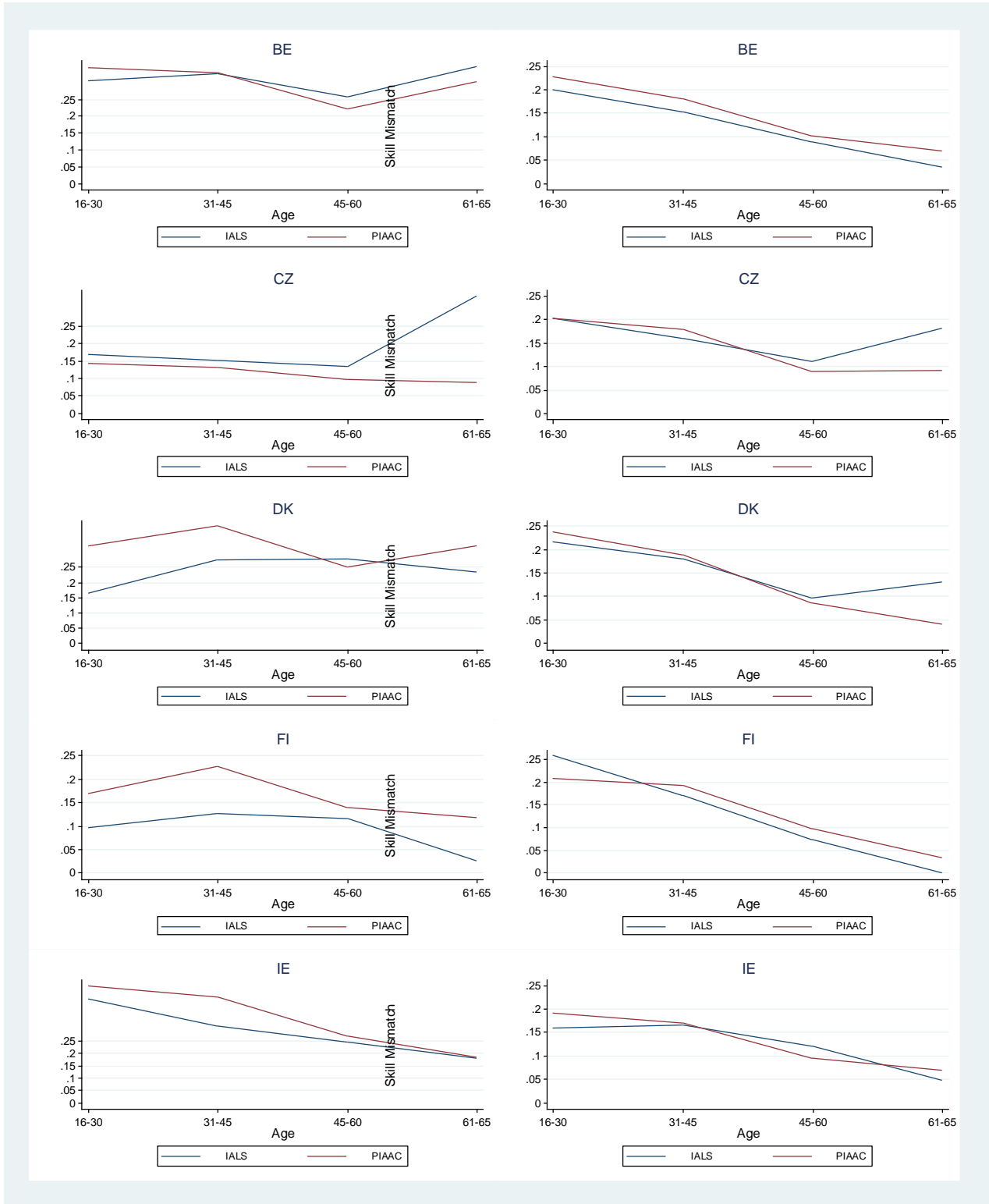


Figure 3. Cohort effects: IT, NL, PL, SE, UK

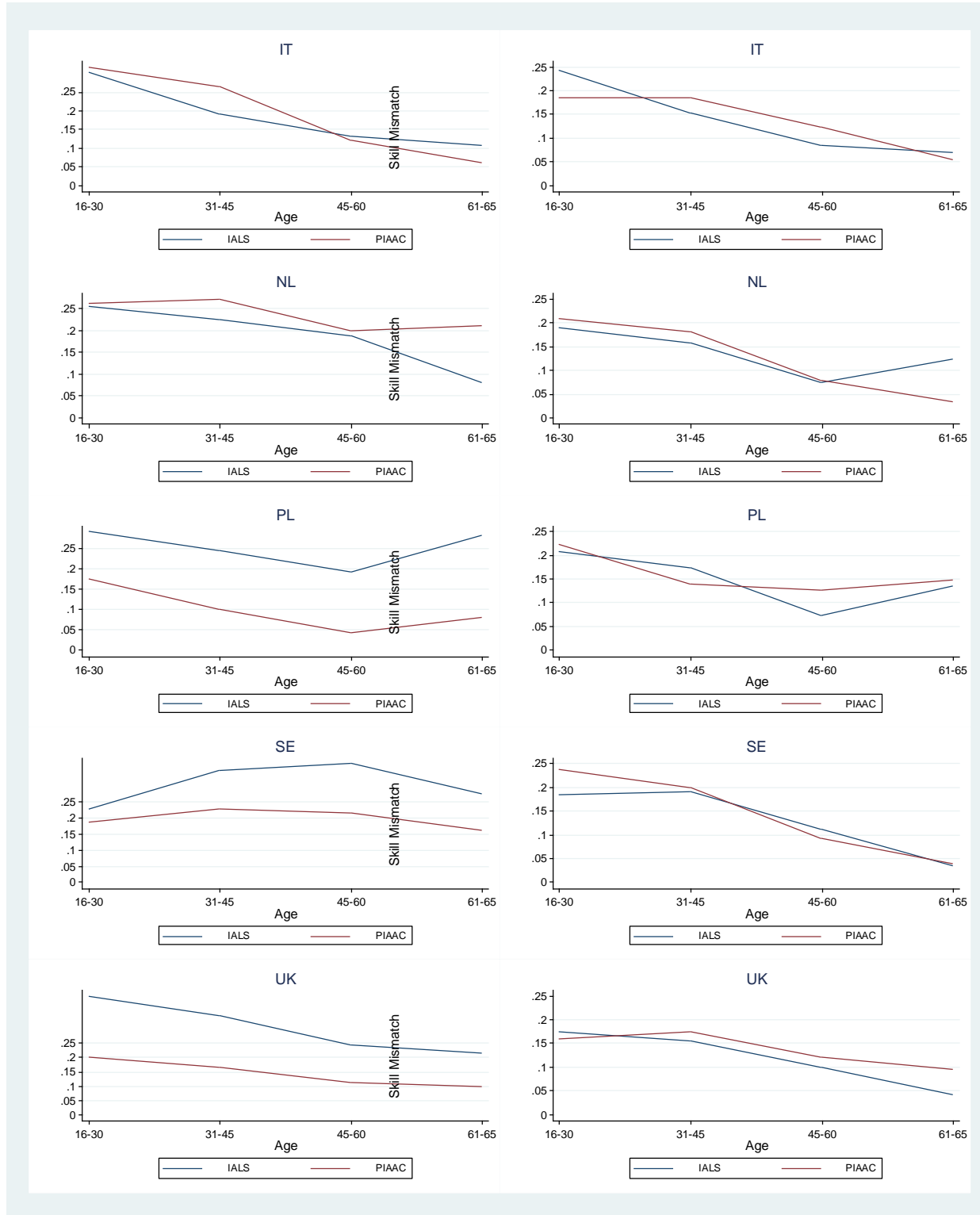


Figure 4 and On the contrary, for **overskilling** (Figure 5) we find that in all countries the general pattern is that of significant decrease in the level of overskilling with age across

all age groups. As speculated earlier on, in these countries ageing is likely to be associated to a deterioration of skills that may drive to a reduction of overskilling when comparing individuals to their peers. Interestingly, the reduction in the share of overskilling is larger for the older age group (31-45); in interpreting this result, it should be considered that, as indicated earlier, the youngest cohorts in IALS were likely still in the education system: the fact that they were probably still accruing additional skills can explain why the effect for the youngest cohorts is not significant, as it is possible that between IALS and PIAAC their skills were growing in the first phase, and then started declining afterwards.

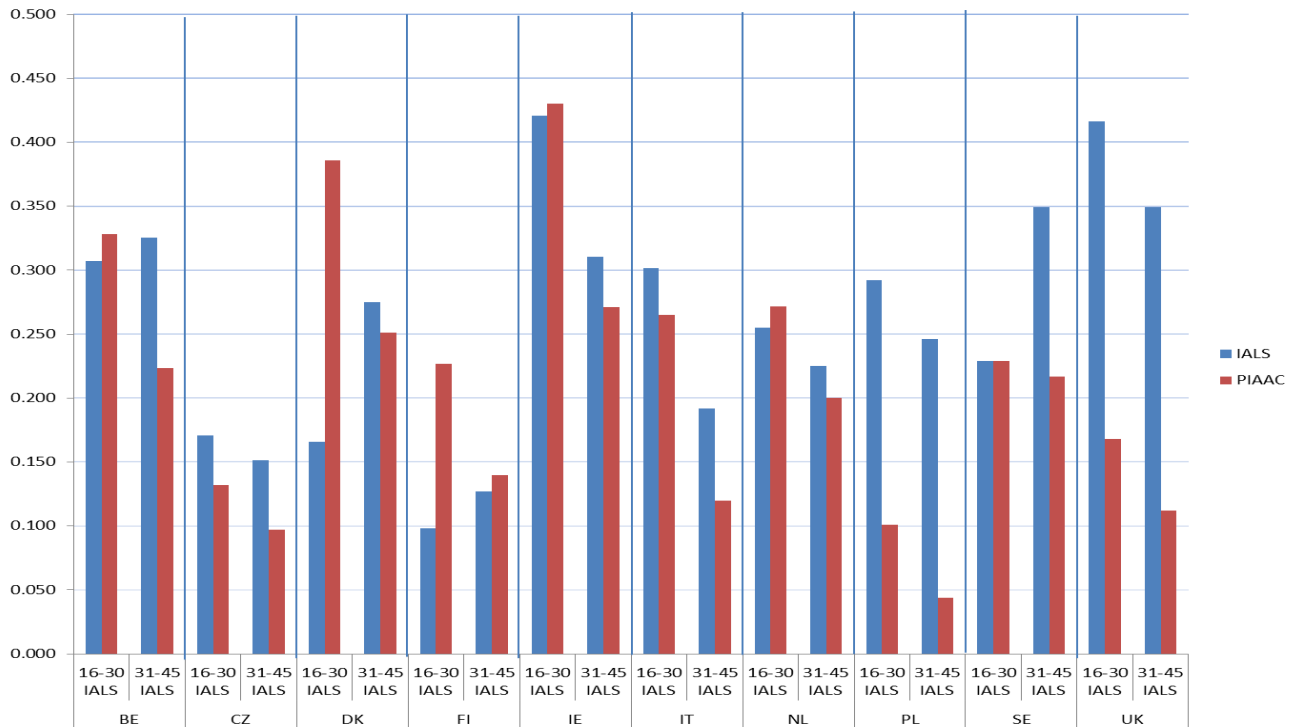
Figure 5 are aimed at illustrating the **ageing effect**. They show a comparison between the the share of overeducated/overskilled individuals for each age cohort in IALS (blue bars) and in PIAAC (red bars); the age of the cohort in IALS is reported at the bottom of the chart. Only two age groups are represented (i.e. 16-30 and 31-45) since they are better represented in both surveys. The red line represents average IALS scores, and the blue line represents PIAAC ones. Thus, for example, whenever the red bars are below the blue ones (in On the contrary, for **overskilling** (Figure 5) we find that in all countries the general pattern is that of significant decrease in the level of overskilling with age across all age groups. As speculated earlier on, in these countries ageing is likely to be associated to a deterioration of skills that may drive to a reduction of overskilling when comparing individuals to their peers. Interestingly, the reduction in the share of overskilling is larger for the older age group (31-45); in interpreting this result, it should be considered that, as indicated earlier, the youngest cohorts in IALS were likely still in the education system: the fact that they were probably still accruing additional skills can explain why the effect for the youngest cohorts is not significant, as it is possible that between IALS and PIAAC their skills were growing in the first phase, and then started declining afterwards.

Figure 5), results indicate that the share of overskilled individuals for that age group have decreased with age between the two surveys; this result may likely be due to a skill loss at individual level that decreases overskilling when compared with her peer group.

For the **ageing effect** we can identify the following patterns:

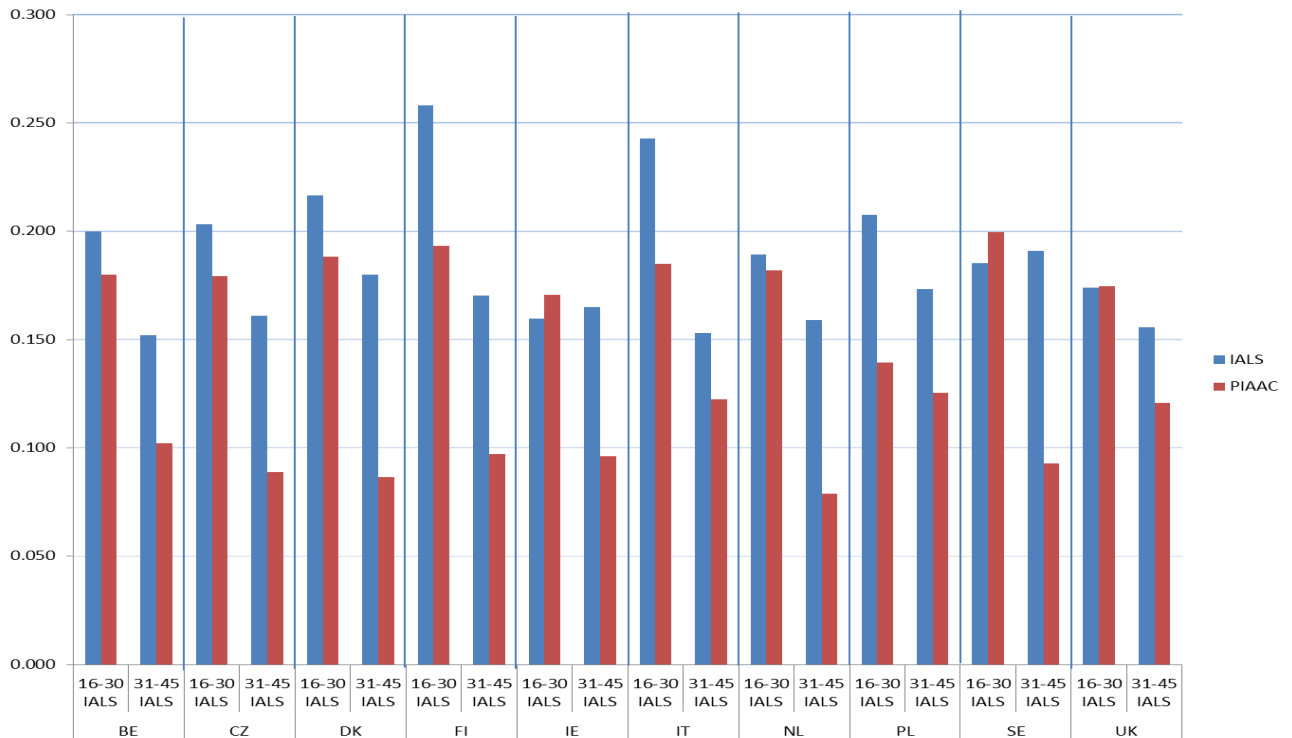
- When we focus on **overeducation** (Figure 4), we find countries like BE, DK, NL, IE, FI and SE where younger individuals in IALS (aged 16-30) show and increase in overeducation 15 years later. This may be due to the fact that some of them (those below 25) may have still been enrolled in education at the time IALS survey took place, and thus not included in the IALS working sample, but then are included in the PIAAC working sample, and being highly educated have greater risk of being overeducated. For FI, this incidence is also found for individuals aged 31-45 but to a much lesser extent.
- Alternatively, we observed how, as expected, overeducation decreases with age in countries like CZ, IT, PL and UK and for the older age group in BE, DK, NL, IE and SE, as it seems that individuals tend to find a matched job later on in life

Figure 4. Ageing effect: Overeducation



- On the contrary, for **overskilling** (Figure 5) we find that in all countries the general pattern is that of significant decrease in the level of overskilling with age across all age groups. As speculated earlier on, in these countries ageing is likely to be associated to a deterioration of skills that may drive to a reduction of overskilling when comparing individuals to their peers. Interestingly, the reduction in the share of overskilling is larger for the older age group (31-45); in interpreting this result, it should be considered that, as indicated earlier, the youngest cohorts in IALS were likely still in the education system: the fact that they were probably still accruing additional skills can explain why the effect for the youngest cohorts is not significant, as it is possible that between IALS and PIAAC their skills were growing in the first phase, and then started declining afterwards.

Figure 5. Ageing effect: Overskilling



3.3 Overeducation and overskilling by type of occupation.

Lastly, we would like to take a look to the demand-side of the labour market in an attempt to understand how the risk of overskilling/overeducation is related to the occupational composition of the country's labour market. As shown in

With only this information it is not possible to understand why we observe such increase and decrease, thus always at a very descriptive level, in an attempt to better understand the reasons for such a various trends, we look at the socio-economic characteristics of the population in the different countries (see **Error! Not a valid bookmark self-reference.**). Interestingly, we observe that while all countries experience an increase in the share of highly educated individuals, this was particularly larger in PL, SE and the UK and accompanied by an increase in the share of medium level of education individuals for PL and UK. At the same time the distribution within level of occupation remain very similar between the two time periods, at least in SE and UK. We may speculate that, this rise in educational attainment has certainly increase the level of education of the peer group (i.e. ISCO 1C reference), thus decreasing the level of educational mismatch. In IE we observe a similar decrease in proportion of individuals with low education and medium education and a significant increase in the shares of individuals with high education, and at the same time we also notice a decreased in semi-skilled blue occupation, compensated by an increased in the share in skilled and semi-skilled white. Maybe for these reasons we don't observe a decrease in the overall share of individuals who are overeducated, as now more people have higher education but more people are also in higher level occupations.

On the contrary, for countries like IE, DK and FI, this increased in highly educated individuals seems offset by the decrease in medium educated ones, thus causing a small overall increase in over education.

Table 3, the distribution of occupations (i.e. professional, semi-skill white, semi-skill blue and elementary jobs) remains pretty much stable across time in most of the countries (exception being IE and BE), with no significant differences between IALS and PIAAC data. Thus, this distribution of occupations should be an accurate reflection of the available job opportunities the worker might be able to take based on her skills, experience and educational attainment. Assuming a limited labour mobility within a country, excessive overeducation/overskilling may pose some interesting policy challenges so as to better adjust local/regional/national supply and demand and to tackle the consequences generated by a significant increase in educational attainment, for example.

Figure 6. Scatter plot on the share of “overeducation only” and “overskilled only” by type of occupation

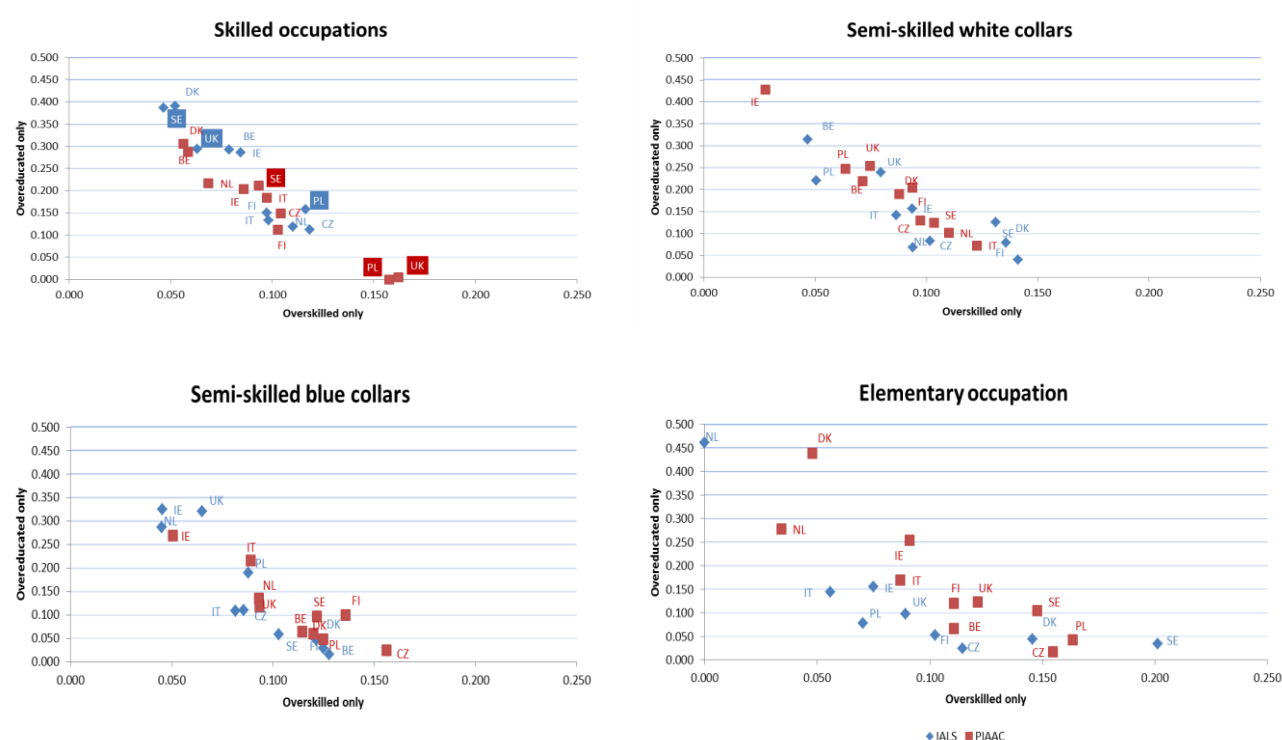


Figure 6 provides a scatter plot with the shares of individuals overeducated only and overskilled only by type of occupation and country. A couple of observations are worth commenting. First, as initially discussed, UK, PL and SE are countries which have assisted a significant decrease in the share of overeducated individuals. However, when looking by type of occupation, we observe that this significant decrease in overeducation has taken place at the level of skilled occupations for all 3 countries and UK and PL for semi-skill blue collars occupations. Skilled occupations by definition are more likely to be taken by individuals with high education attainment and very specific skills, this decrease in the level of overeducation may be the result of a better match with peers. Nonetheless, these three countries are hiring at these levels (skilled and semi-skill blue) individuals with more skills than those required for the job. No significant shifts across time are observed for other type of occupations.

Second, interestingly, for the case of SE in elementary occupation we observe small increase in overeducation jointly with a moderate decrease of overskilling which may make us speculate with the nature/features of this sub-group of individuals taking basic skill jobs, probably with high level of education but not the appropriate skills (e.g. migrants). This same pattern is follow at a larger extent by DK with a large increase in workers only overeducated but a big decrease in those who claim to be only overskilled. Last, for the rest of countries no big differences are observed across time or type of occupation beyond what was observed for the overall sample.

4 Conclusion

Concerns regarding occupational mismatch in developed economies have been increasing lately, not only on the amount of people occupationally mismatch but also on the persistence of the problem at individual level. Our contribution to this discussion is twofold: (1) the conceptualization of occupational mismatch; thus, we compute occupation mismatch indicators based on both education- (overeducation) and skill-based (overskilling) variables; (2) the look at the evolution of the phenomena across time (allowing to more specifically look at the ageing and cohort effects).

The 1994-1998 International Adult Literacy Survey (IALS) and the 2012 Survey on Adult Skills (PIAAC) are unique datasets providing comparable measures of individual cognitive skills, as well as, educational attainment for a representative sample of the adult age population across a number of OECD countries. Yet, it is important to highlight that both datasets are limited in the number of indicators that we can simultaneously built with both of them to make the desired comparisons. Thus, our analysis has been limited to an education related one and a skill related one, using available ISCO 1 digit occupations which prevent the implementation of a more elaborated and concise analysis.

With this limitation in mind, some results are worth highlighting:

- Our findings confirm previous results suggesting that the various concepts and measures of occupational mismatch are not equivalent and that the phenomena that they capture affect the population to different degrees. In general, we find a negative correlation between individuals who are solely overeducated and those who are solely overskilled in all countries and in both surveys.
- Considering the two time periods, we observe a group of countries (PL, SE and UK) that have decreased their share of only overeducated workers, compensating it with an increase in share of overskilled only individuals with an overall decrease of total mismatch. Thus, these countries seem to be endowed with a reservoir of high-skilled workers, and this is more likely to happen across skilled occupation and semi-skilled blue collar ones which potentially can improve even further their potential performance. For the rest of countries, no significant variations are worth highlighting.
- While overeducation and overskilling are persistent phenomena they seem to decrease as individuals get older. Some room for greater overeducation is observed for the younger cohorts of countries like BE, DK, IE, FI, NL or SE where individuals continue gaining educational attainment but it is not a persistent problem.
- Recent generations are more likely to be affected by overeducation in DK, FI and IE, (and IT, BE and NL to a much lesser extent) particularly those aged 16 to 45 compared to their 16-45 peers 15 years ago.

In summary, occupational mismatch, whether understood as skill or education mismatch is present in all countries studied at a greater or lesser extent, affect more to younger individuals than their older counterparts and present some heterogeneity by type of occupation. Efforts cannot be abandoned so as to ensure better match between supply and demand.

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